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ABSTRACT

To give those business and vocational educators involved in curriculum development a better understanding of data processing personnel requirements, a study was initiated to determine the status of data processing equipment and personnel in selected Pennsylvania businesses. Following a literature review, a questionnaire was developed, revised, and sent to 1,851 Pennsylvania businesses. Data analysis was based on 453 usable responses. Conclusions were drawn concerning the need for various occupations: keypunch operators, data entry operators, EAM operators, computer console operators, librarians (tape disk), business programmers, scientific programmers, systems programmers, and systems analysts. For example, it was determined that keypunch operators will be needed in the next five years in all standard industrial classification categories and in all sizes of businesses, and scientific programmers will be needed by a relative few; 76% show no need for increasing their scientific programming staff in the next five years. Additional conclusions were drawn concerning occupations' educational requirements, computer language usage, business size and needs, and equipment usage trends. Recommendations for business educators include (1) continue teaching data processing using unit record equipment; (2) equally emphasize skills and applications areas; (3) stress data processing concepts instead of hardware; and (4) build curriculum based on area and business needs. (CSS)

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A Study to Determine the Skills and Knowledges Required for Personnel in Business Data Processing Centers to Develop a Relevant Curriculum for Secondary Data Processing Programs and for Data Processing Programs in Teacher Education

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A Research Study
by

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A STUDY TO DETERMINE THE SKILLS AND KNOWLEDGES REQUIRED FOR PERSONNEL IN BUSINESS DATA PROCESSING CENTERS TO DEVELOP A RELEVANT CURRICULUM FOR SECONDARY DATA PROCESSING PROGRAMS AND FOR DATA PROCESSING PROGRAMS IN TEACHER EDUCATION

Rationale

The entire field of data processing is constantly in a state of flux. In the fifties, the big thing was unit record equipment. The sixties saw the advent of computers in business. The seventies depicts an era of more and faster computers.

Users of data processing equipment are constantly searching for some type of guide as to what other uses are doing as far as data processing equipment and personnel are concerned.

Educators need to have a knowledge of what is being used in the business world along with the necessary skills and knowledge of the personnel involved.

With the increased use of computers, unit record equipment has been termed obsolete; however, is it obsolete or just placed in the background?

Purpose of the Study

It is hoped that this study will determine the status of data processing equipment and personnel in selected Pennsylvania businesses so that business and vocational educators will have a better understanding

of the requirements in data processing that business demands. If it is found that unit record equipment has a limited use or will no longer be required, perhaps other related data processing skills could be included in the curriculum of the future.

State of the Problem

What skills and knowledges are required of employees in business data processing centers with implications for developing a relevant curriculum for secondary data processing programs and for teacher education?

Delimitations

This study was limited to the state of Pennsylvania, and in no way makes any assumptions concerning other states.

The names of participants in this study were taken from Dun and Bradstreet's Million Dollar Directory and Dun and Bradstreet's Middle Market; therefore, the Standard Industrial Classification for government offices and firms not listed in these directories were not used in this study.

The business firms selected had a minimum of five employees.

Businesses which operate under different names but at the same mailing address were contacted only at the first listing.

The study included the cities of Philadelphia, Pittsburgh, Allentown, Erie, Scranton, Altoona, Bethlehem, Chester, Harrisburg, Reading, Wilkes-Barre, York, Lancaster; 10 percent of the cities with a population of 10,000 to 49,000 were randomly selected (nine cities) and ten percent of the towns with a population of 1,000 to 9,999 were randomly selected (69 towns).

Procedures

After reading available current literature and previous studies on the use of data processing equipment and the skills and knowledge of related personnel, a questionnaire was developed, refined, and tested in a pilot study. Those personnel managers participating in the pilot study generally made the same comments for the improvement of the questionnaire; the questionnaire was revised to incorporate their suggestions.

The reference book, Characteristics of the Population, Volume 1, Pt. 40, Sec. 1, was used to study the population spread of Pennsylvania. All of the cities with a population of 50,000 or more were selected; 10 percent of the cities with a population of 10,000 to 49,999 were randomly selected as were 10 percent of the towns with a population of 1,000 to 9,999.

For these selected cities, Dun and Bradstreet's Middle Market and Million Dollar Directory were used to secure the company name and address, Standard Industrial Classification (SIC), and number of employees. All businesses listed with five or more employees were included in the study.

Each business firm chosen was assigned a chronological number beginning with one. The number was keypunched along with the name, address, city, state, SIC, and the number of employees.

Mailing labels were then printed to include the title "Data Processing Manager," name of business, address, city, state, and the identification number.

The questionnaires were numbered chronologically also. The mailing included a cover letter, numbered questionnaire, and a self-addressed, postage paid return envelope.

Another set of data cards was punched to include the identification number, name of company, SIC, and the number of employees. As the questionnaires were returned, the corresponding data cards were pulled and the data punched daily.

The address cards used for mailing labels were also pulled as the questionnaires were returned and kept separate. A second mailing label was printed for each company not responding to the first letter.

A follow-up letter and a second questionnaire, which was numbered, were forwarded to all businesses which did not return the questionnaire by the requested date.

The questionnaires received in response to the follow-up letter were handled in the same manner as the first group.

Programs were written for the computer to tabulate the results of the questionnaire responses.

CHAPTER II

REVIEW OF THE LITERATURE

Several studies have been completed on different aspects of data processing equipment or educational background of personnel. The following views of several authors give a summary of literature in the areas of equipment surveys and data processing personnel.

A business office may be viewed as a series of information centers where information is collected, produced, distributed, and used. Consequently, when setting performance goals and revising curricula, business educators must consider new developments in terms of the information handling concept of the office. The concept is significant because projections for the next decade call for one million more people in the data processing occupations than there were in 1974.[1] Half the opportunities are expected to be in programming; the other half, in the more routine support tasks.[2]

Brady[3] indicated that the job market for programmers and for electronic data processing people with some programming experience is on the way up.

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[1] Occupational Outlook Handbook, United States Bureau of Labor Statistics, United States Department of Labor, Bulletin 1785 (Washington: Government Printing Office, 1974), pp. 110-111.

[2] Ibid., p. 111.

[3] Raymond Brady, (ed.), "Thaw for Computer Programmers," Dun's (January, 1973), pp. 71-72.

Philippakis'[4] survey of 164 businesses such as banks, utilities, manufacturing firms, retail firms, insurance companies, and federal, state, city or county governments indicated that most businesses prefer to use languages such as Formulae Translation (FORTRAN) and Common Business Oriented Language (COBOL) because of their machine independence and versitility. The survey also indicated that among the 84 percent of those companies that responded, 74 percent of the programming was done in COBOL. FORTRAN was used for about 10 percent of all programming tasks.

Herriot's[5] survey comparing computer education programs offered in colleges and computer education requirements by industry, indicated that colleges were overtraining programmers, that they placed too much emphasis on programming and not enough on applications. Borcher and Joyner[6] indicated that his could be overcome by teaching the actual tasks encountered in industry.

Roberts states that experts in the field of data processing forecast continued expansion in computer use and further advances in computer technology. These two developments will bring about hundreds of additional computer-related jobs. It has been projected that by 1990 as much as

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[4]Andreas S. Philippakis, "Programming: Cobol vs. Assembly Language in Data Processing." Data Management, Vol. 12, No. 7, (July, 1974), pp. 20-21.

[5]Robert G. Herriot, "The Definition of the Control and Environment Structure of Programming Languages" (unpublished Ph.D. dissertation, University of Wisconsin, 1971), p. 51.

[6]Sidney D. Borcher and John W. Joyner, Business Data Processing Occupational Performance Survey (Ohio: Ohio State University, 1973), pp. 82-83.

20 percent of the labor force will require some knowledge of data processing. A slow down in the rate of growth due to the advances in hardware and software will no doubt come, but it will be many years away.[7]

Curless[8] states in his findings that a high school diploma is sufficient training for entry into the various computer positions, such as computer operator, tabulating and peripheral equipment operator and tape librarians.

Overton[9] writes that graduates of community colleges may enter into the following data processing jobs: computer operator, computer programmer, cooperative computer programmer trainee and data processing coordinator. Except for programming, all of the above positions require only a high school level of education.

Nord[10] in his article, states that the majority of business organizations use COBOL 85-100 percent of the time. FORTRAN is not extensively used for business applications; its use is limited to about 10 percent of the applications in business.

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[7]Don Roberts, "Employment Outlook for Data Processing Occupations." Journal of Data Education, Vol. XVIII, No. 5, (November, 1978), pp. 24-25.

[8]Jack C. Cruless, "A Comparative Analysis Between 1969 and 1973 of the Minimum Educational Requirements Necessary for Entry into Thirteen Types of Electronic Data Processing Positions." (unpublished Ed.D. dissertation, Northern Illinois University, 1973).

[9]R. Jean Overton, "Business Data Processing Curriculum in the Community Colleges and Technical Institutes and Data Processing Job Classifications in Selected Businesses and Industries in North Carolina." (unpublished Ed.D. dissertation, University of North Carolina, 1973).

[10]G. Daryl Nord, "Programming Languages in the Business Environment." Journal of Data Education, Vol. XVIII, No. 4, (July, 1978), pp. 15-16.

Miller[11] in his article points out that audio and voice response systems are growing better and giving the computer more to say than ever before, and they are sounding more like humans, too.

According to Computer Decisions,[12] you can expect the CRT terminal to remain the dominant device for displaying data and graphics.

All systems analysts, for example, eventually discover that they need a knowledge of business principles to succeed in their careers. Programmers and analysts feel a need to learn accounting principles.[13]

Bruun[14] states that against the existing setting, a new movement calls strongly for an information systems curriculum not constrained by computer science's emphasis on solving algorithmic problems. Instead it would aim at the dynamics of system applications. Business-oriented types with good communications skills will, for some time, make the best information analyst candidates. Computer science grads will do the job in the systems design area.

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[11]Frederick W. Miller, "Talk It Over With Your Computer." Infosystems, (August, 1978), pp. 62-65.

[12]Mel Mandell, (ed.), "CRT Display Terminals," Computer Decisions, (September, 1978), pp. 62-63.

[13]Robert R. Ware, "Can the University Train DP Personnel?" Infosystems, (November, 1976), pp. 52-54.

[14]Roy J. Bruun, "Education: No Interface From Campus to Corporation," Infosystems, (June, 1974), pp. 34-36.

CHAPTER III

FINDINGS

A copy of the questionnaire was sent to 1,851 businesses in Pennsylvania. Of those sent, 758 were returned, and 453 were considered usable. Most of the 305 termed unusable did not have any data processing equipment or sent their data processing work to a service company. When analyzing the data, the findings were based on a total of 453 replies to the questionnaire.

The data was analyzed by the follwoing variables; total response, SIC, and total number of employees.

Indicate Projected Increase in Number of Employees Needed in the Next Five Years.

The response of the various types of businesses for selected data processing related job classifications is summarized in Table 1. Tables 2 thru 10 show the results of the selected job classifications by SIC, and by total number of employees for each firm.

TABLE 1

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Keypunch operator	53	37	8	1	1
Data entry operator	28	53	9	6	2
EAM operator	86	9	1	3	1
Computer console operator	29	59	10	1	1
Librarian (tape-disk)	63	31	3	2	1
Business programmer	26	56	10	5	3
Scientific programmer	76	19	3	1	1
Systems programmer	41	54	2	2	1
Systems analyst	42	44	10	2	2

TABLE 2

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR KEYPUNCH OPERATORS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry		100			
Mining	40	40	20		
Construction	50	50			
Manufacturing	59	34	6		
Transportation, Communication Public Utilities	47	40	13		
Wholesale Trade	52	40	7		1
Retail Trade	54	40	6		
Finance, Insurance, Real Estate	53	38	6	3	
Services	28	44	14		14
TOTAL EMPLOYEES					
1-9	60	30	10		
10-19	70	30			
20-49	46	44	7		3
50-99	66	32	2		
100-249	65	34	1		
250-499	41	47	8	4	
500-999	49	45	6		
Over 1000	44	34	18		4

Table 2 indicates that in the next five years, keypunch personnel will be needed more in the area of agriculture, mining, construction, transportation, public utilities and service jobs. Table 2 also indicates that generally the larger number employed in the firm, the better the possibility that keypunch personnel will be needed.

TABLE 3

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR DATA ENTRY OPERATORS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	66	34			
Mining	40	40		20	
Construction	34	66			
Manufacturing	30	55	7	4	4
Transportation, Communication Public Utilities	53	29	7	11	
Wholesale Trade	22	70	7	1	
Retail Trade	17	67	11		5
Finance, Insurance, Real Estate	21	51	18	5	5
Services	22	56	22		
TOTAL EMPLOYEES					
1-9	30	30	30	10	
10-19	53	40	7		
20-49	35	60	5		
50-99	28	68	2		2
100-249	24	64	6	4	2
250-499	25	65	8	2	
500-999	26	48	18	8	
Over 1000	32	30	16	10	12

Table 3 shows that data entry operators will be needed in all types of firms except possibly agriculture. The size of firm does not seem to be dependent on their need for data entry operators in the next five years. Table 3 shows that logically the more employees the more the need for data entry operators.

TABLE 4

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR EAM OPERATORS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	100				
Mining	60	40			
Construction	80			20	
Manufacturing	83	14	3		
Transportation, Communication Public Utilities	100				
Wholesale Trade	96	4			
Retail Trade	84	16			
Finance, Insurance, Real Estate	86	9	5		
Services	75				25
TOTAL EMPLOYEES					
1-9	100				
10-19	100				
20-49	100				
50-99	88	6	6		
100-249	86	12		2	
250-499	78	22			
500-999	93	7			
Over 1000	78	9	3		

Table 4 indicates that there still might be some EAM operator jobs available in the mining, construction and retail trade industries. It also shows that job needs for EAM operators are only in the medium to large business firms.

TABLE 5

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR COMPUTER CONSOLE OPERATORS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	25	75			
Mining	50	25		25	
Construction	48	52			
Manufacturing	25	65	9	1	
Transportation, Communication Public Utilities	48	38	14		
Wholesale Trade	32	65	3		
Retail Trade	35	60	5		
Finance, Insurance, Real Estate	19	66	10	1	4
Services	28	58	14		
TOTAL EMPLOYEES					
1-9	50	42	8		
10-19	55	45			
20-49	28	64	8		
50-99	36	58	4	2	
100-249	39	56	3	2	
250-499	20	75	5		
500-999	33	65	2		
Over 1000	14	50	28	1	7

Table 5 illustrates that there is still a definite need for computer console operators with no regard to type of firm or size of the business. Again, generally the larger the firm, the more they will need computer console operators.

TABLE 6

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR LIBRARIAN (TAPE-DISK)

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	100				
Mining	80	20			
Construction	66	17			17
Manufacturing	65	34	1		
Transportation, Communication Public Utilities	58	42			
Wholesale Trade	85	15			
Retail Trade	66	34			
Finance, Insurance, Real Estate	51	39	6	2	2
Services	25	50			25
TOTAL EMPLOYEES					
1-9	66	34			
10-19	100				
20-49	85	15			
50-99	72	24	4		
100-249	78	20			2
250-499	64	36			
500-999	48	52			
Over 1000	42	46	6	2	4

Table 6 shows that few tape or disk librarians are needed except for possibly transportation, communication, public utilities, manufacturing, retail, finance, and services. Generally, the larger firms are the places where there is a greater need for some tape-disk librarians.

TABLE 7

PROJECTED INCREASE IN NUMBER OF EMPLOYEES NEEDED IN THE NEXT FIVE YEARS BY PERCENT ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES FOR BUSINESS PROGRAMMERS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	50	25	25		
Mining	17	66	17		
Construction	46	47	7		
Manufacturing	27	59	9	1	4
Transportation, Communication Public Utilities	22	56		22	
Wholesale Trade	26	70		4	
Retail Trade	20	74	6		
Finance, Insurance, Real Estate	24	40	21	10	5
Services	16	34	34		16
TOTAL EMPLOYEES					
1-9	11	56	22	11	
10-19	50	50			
20-49	34	50	8	8	
50-99	42	55	3		
100-249	38	56	3	3	
250-499	23	68	7	2	
500-999	14	70	12	4	
Over 1000	13	38	23	11	15

Table 7 illustrates the tremendous need for business programmers in all types of busineses. As far as size, the extremely small and the medium-to-large firms show a definite need for business programmers for at least the next five years.

TABLE 8

PROJECTED INCREASE IN NUMBER OF EMPLOYEES NEEDED IN THE NEXT FIVE YEARS BY PERCENT ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES FOR SCIENTIFIC PROGRAMMERS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	66		34		
Mining	80	20			
Construction	45	40			11
Manufacturing	70	25	4		1
Transportation, Communication Public Utilities	57	37	6		
Wholesale Trade	100				
Retail Trade	80	20			
Finance, Insurance, Real Estate	88	9			3
Services	40	20	20	20	
TOTAL EMPLOYEES					
1-9	60	20	20		
10-19	88	1	11		
20-49	100				
50-99	80	15	5		
100-249	82	15			2
250-499	85	10		5	
500-999	77	23			
Over 1000	46	42	7		5

Table 8 shows a definite decreasing need for scientific programmers except for possibly construction and service type industries. The need for scientific programmers is shown in only the extremely large firms.

TABLE 9

PROJECTED INCREASE IN NUMBER OF EMPLOYEES
NEEDED IN THE NEXT FIVE YEARS BY PERCENT
ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES
FOR SYSTEMS PROGRAMMERS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	34	66			
Mining	34	66			
Construction	77	12			11
Manufacturing	42	46	4	5	3
Transportation, Communication Public Utilities	50	46	4		
Wholesale Trade	51	49			
Retail Trade	46	54			
Finance, Insurance, Real Estate	25	66	5	3	1
Services	34	66			
TOTAL EMPLOYEES					
1-9	10	90			
10-19	70	20	10		
20-49	56	44			
50-99	60	32	4	4	
100-249	63	36			1
250-499	28	70	2		
500-999	40	60			
Over 1000	20	59	7	9	5

Table 9 would tend to indicate a need for systems programmers in all but the construction industry. The need is pointed up in the very small and very large firms. Generally, there is a definite need for systems programmers in the next five years.

TABLE 10

PROJECTED INCREASE IN NUMBER OF EMPLOYEES NEEDED IN THE NEXT FIVE YEARS BY PERCENT ACCORDING TO SIC AND TOTAL NUMBER OF EMPLOYEES FOR SYSTEMS ANALYSTS

	NUMBER PROJECTED IN NEXT FIVE YEARS				
	No Increase	1-5	6-10	11-20	Over 20
Agriculture, Forestry	66			34	
Mining	50	50			
Construction	50	40			10
Manufacturing	38	47	10	2	3
Transportation, Communication Public Utilities	55	34	11		
Wholesale Trade	51	47	2		
Retail Trade	60	40			
Finance, Insurance, Real Estate	33	51	11	5	
Services	28	29	29		14
TOTAL EMPLOYEES					
1-9	14	58	14	14	
10-19	66	23	11		
20-49	75	20	5		
50-99	66	27	7		
100-249	57	42			1
250-499	38	57	5		
500-999	23	70	7		
Over 1000	14	49	21	9	7

Table 10 reveals that there is probably a fifty percent chance of a need for systems analyst jobs in most types of businesses. It also shows a proportional need for systems analysts based on the size of the firm. The very small firm also shows an extremely high need for systems analysts in the next five years.

What are Your Minimum Educational Requirements for Each Job and is the Job an Entry Level Position?

Table 11 illustrates the total responses from the survey. The SIC catagories and the size of company did not seem to vary much from the total illustration. Consequently, no breakdown by SIC or size will be given.

TABLE 11

MINIMUM EDUCATIONAL REQUIREMENTS FOR EACH JOB CLASSIFICATION AND ENTRY LEVEL STATUS FOR TOTAL

	H/S	Vo/Tech	2-year Associate	Bachelors Degree	Other	Entry Level YES
Keypunch operator	75%	22%	1%	1%	1%	89%
Data entry operator	76	18	3	2	1	90
EAM operator	68	20	8	2	2	73
Computer console operator	62	25	10	1	2	65
Librarian (tape-disk)	66	16	12	5	1	58
Business programmer	26	14	31	26	3	57
Scientific programmer	12	6	16	62	4	34
Systems programmer	20	12	21	44	3	22
Systems analyst	22	5	15	53	5	20

Table 11 shows a direct parallel between educational requirements and entry level position. The operator type jobs show high school, vocational technical school educational requirements at an entry level position. The programmer and analyst type jobs show a need for a

degree type background and are generally not entry level position except for possibly the business programmer catagory.

The SIC's and size of business did not show any appreciable variation from the reported totals given in Table 11.

Check the Computer Languages Used by Each Job Classification by Indicating Percent of Total Language Usage.

The different SIC's and sizes of companies did not differ significantly from that of the totals shown in Table 12. Generally speaking, COBOL, RPGII and Assembly are used as business languages; and FORTRAN, BASIC and Assembly are used as scientific languages.

TABLE 12

PERCENTAGE OF TOTAL
LANGUAGE USAGE

	COBOL	RPGII	FORTRAN	BASIC	ASSEMBLY	
Business programmer	43%	38%	5%	7%	7%	100%
Scientific programmer	11	13	61	6	9	100
Systems programmer	33	29	7	25	6	100
Systems analyst	46	33	9	8	4	100

Table 12 might be used to indicate which programming language should be taken with regard to a persons vocational choice in the data processing field.

Indicate the Desired Background by Percent for the Following Job Classifications.

and

Indicate the Percentage of Total Time Spent by the Different Job Classifications in Each Applications area.

These two questions might well be combined to show the relationship of background to applications areas. Again, generally, there was no significant difference between the results shown in Table 13 for the total and the SIC's or sizes of industries.

TABLE 13

EDUCATIONAL BACKGROUND
AND
APPLICATIONS AREAS
BY PERCENT

	APPLICATIONS AREAS				BACKGROUND	
	BUSINESS	SCIENTIFIC	SOFTWARE	HARDWARE	BUSINESS	MATH'COMP.
Business programmer	75%	3%	17%	5%	66%	34%
Scientific programmer	15	59	19	7	19	81
Systems programmer	40	3	42	15	46	54
Systems analyst	69	4	18	9	64	36

Table 13 would tend to indicate that for whichever vocational field was chosen, the type of background that would be needed. It also shows what proportionate share of time would be spent in each applications area for that chosen field.

As you would expect, Table 13 points out the relationship between applications areas and educational background very vividly.

Indicate Possession of Unit Record Equipment.

Table 14 reveals the total picture of the 453 responses as to whether they have unit record equipment. The SIC breakdown does not show a significance between each of the nine classifications and the total in Table 14. However, there are slightly higher percentages reported in the 250 employees and over catagories.

TABLE 14

UNIT RECORD EQUIPMENT
BY PERCENT FOR TOTAL

EQUIPMENT	PERCENT
Sorter	36
Collator	14
Reproducer	17
Interpreter	16
Accounting machine	11
Keypunch	51
Keyverifier	27

Table 14 shows that there are adequate numbers of unit record equipment in the field to justify keeping unit record concepts in the curriculum. Compare Table 14 with Table 15 which shows the increased usage of unit record equipment for firms with over 1000 employees. Table 15 tends to show that unit record equipment is still very much alive as a means to feeding information to the computers. The companies with more computers tend to have more unit record equipment. A higher

percentage of the larger companies have unit record equipment. Thus it might be safe to say that there is still a market for unit equipment operators.

TABLE 15

UNIT RECORD EQUIPMENT
BY PERCENT FOR OVER 1000 EMPLOYEES

EQUIPMENT	PERCENT
Sorter	58
Collator	28
Reproducer	34
Interpreter	36
Accounting machine	7
Keypunch	78
Keyverifier	43

Indicate Possession of Computer Equipment.

Table 16 depicts the total catagory of computer equipment. The SIC breakdown, like the unit record equipment results, shows no significant difference from that of the total in Table 16. However, similar to unit record equipment, the over 1000 employees catagory in Table 17 illustrates a substantial increase over the total. Again the larger the firm the more equipment it will have, both unit record and computers. Note especially the increase in the CRT terminals, teletype terminals

and the batch terminals. It would seem that the larger company with more equipment tend to do more remote processing of data than the average shown for the total.

TABLE 16

COMPUTER EQUIPMENT
BY PERCENT FOR TOTAL

EQUIPMENT	PERCENT
Magnetic tape	38
Magnetic disk	67
Paper tape	12
Magnetic drum	3
Key/tape	6
Key/disk	25
Card reader	49
Card punch	44
CRT terminal	49
Teletype terminal	20
Batch terminal	18

TABLE 17

COMPUTER EQUIPMENT
BY PERCENT
FOR OVER 1000 EMPLOYEES

EQUIPMENT	PERCENT
Magnetic tape	79
Magnetic disk	90
Paper tape	18
Magnetic drum	6
Key/tape	12
Key/disk	51
Card reader	82
Card punch	73
CRT terminal	73
Teletype terminal	39
Batch terminal	40

Indicate Each of the Following Input/Output Devices You Use:

Table 18 reveals the percent of usage for the total. The SIC breakdown consistantly reveals no significant difference from that of the total.

TABLE 18

INPUT/OUTPUT USAGE
BY PERCENT FOR TOTAL

EQUIPMENT	PERCENT
Keypunch	53
Key/tape	9
Key/disk	28
Key/cassette	12
Disk drive	66
Tape drive	34
Paper tape reader/punch	13
Magnetic drum	3
Data cell	3
Card reader	49
Card punch	44
CRT terminal	53
Teletype terminal	21
Remote batch terminal	18
Optical mark page reader	2
Optical scanner (OSR)	2
Optical character (OCR)	5
Magnetic ink character (MICR)	7
Graphic units	4
Audio response units	4
Micro-film	16

TABLE 19

INPUT/OUTPUT USAGE
BY PERCENT FOR
OVER 250 TOTAL EMPLOYEES

EQUIPMENT	PERCENT 250-499	500-999	Over 1000
Keypunch	60	75	81
Key/tape	8	10	19
Key/disk	35	27	48
Key/cassette	12	12	10
Disk drive	74	90	88
Tape drive	37	54	78
Paper tape reader/punch	9	21	29
Magnetic drum	3	2	9
Data cell	0	4	2
Card reader	58	77	85
Card punch	52	73	75
CRT terminal	58	58	79
Teletype terminal	23	31	43
Remote batch terminal	14	28	48
Optical mark page reader	3	4	6
Optical scanner (OSR)	2	0	4
Optical character (OCR)	3	4	15
Magnetic ink character (MICR)	9	4	12
Graphic units	5	4	7
Audio response units	5	4	9
Micro-film	8	19	55

Table 19 shows the percentage of increase for total employees catagories over 250. The catagories under 250 show no significant difference from that of the total illustrated in Table 18.

Note the increased usage of computer remote equipment in Table 19 over the total. These figures would tend to be explained because of the natural tendancy for the large firm to have more equipment and for more of the larger firms to be using remote processing.

CHAPTER IV

CONCLUSIONS

1. Keypunch operators will be needed in the next five years in all SIC catagories and in all sizes of businesses.

2. Data entry operators will be needed in most SIC catagories and in the medium to large companies.

3. EAM operators will be needed in small numbers, mainly in the medium to large companies.

4. Computer console operators will be needed in all SIC catagories and by all sizes of companies.

5. Librarian (Tape-Disk) jobs will be needed primarily in the larger business firms.

6. Business programmers will be in demand by all SIC catagories and especially in the larger firms with more computers.

7. Scientific programmers will be needed by a relative few; 76 percent show no need for increasing their scientific programming staff in the next five years.

8. Systems programmers and systems analysts jobs will share an increased need in all SIC catagories and in all sizes of companies. Systems programmers will be needed to a greater degree in the very small and the very large firms.

9. Minimum educational requirements of a high school education is expected for keypunch operators, data entry operators, EAM operators, computer console operators, and librarian type jobs in data processing.

10. Over 50 percent surveyed show that business programmers, scientific programmers, and systems ananlysts type jobs need a 2-year or bachelor's degree.

11. COBOL and RPGII account for over 60 percent of language usage for a business programmer, systems programmer, and the systems analyst type jobs.

12. FORTRAN is used over 60 percent of the time for the scientific programmer jobs.

13. Applications areas which show a high percentage in the business area also show a direct correlation with business as a preferred background. The same would hold true for the scientific area.

14. Although the need for increased personnel in the area of unit record equipment shows only a slight increase, the use of the equipment depicts that the medium to large companies have and use this equipment.

15. The use of computer equipment increases as the size of the company increases.

16. Input/output usage shows the same result. The larger the firm, the more there is usage of the equipment.

17. Equipment on the upswing might include: key/disk, disk drive, CRT terminals, and microfilm equipment.

18. Equipment on the downtrend might include: keypunch, tape drive, paper tape reader/punch, and teletype.

19. The larger firms seem to be placing emphasis on remote computing with the increased use of CRT terminals, batch terminals, teletypes, graphic and audio units and remote data entry devices.

CHAPTER V

RECOMMENDATIONS

1. Business educators should continue to teach the concepts of data processing using unit record equipment. However, the objectives should be to prepare students for a wide variety of entry level jobs in the data processing field.

2. Business educators should place equal emphasis on the skills and applications areas. They should not dwell too heavily on the skills areas.

3. Concepts of data processing should be stressed instead of hardware. The trend in data processing has shown that hardware is changing rapidly, but that the concept of its use is fairly constant.

4. Business educators should take a look at the results here and choose their own course of action for building their curriculum. They should build the curriculum based on their surrounding area and the type of businesses found in that area.

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APPENDIX

SHIPPENSBURG STATE COLLEGE • SHIPPENSBURG, PENNSYLVANIA 17257

June 6, 1978

Dear Sir:

Please don't toss this in your circular file! We need your help!

We want to review our data-processing curriculum for business teachers. In order to do this objectively, we need to know the needs and requirements of business for the different data-processing positions.

You have been selected to be a participant in this state-wide survey. Will you please complete the enclosed questionnaire based on your company's practices. All data will be kept confidential.

Please return the questionnaire by June 21, 1978, using the enclosed addressed, stamped envelope. Your cooperation in this study will help business educators better prepare students for employment in business offices.

Sincerely,

Ruth D. Armstrong

Ruth D. Armstrong, Chairman
Business Education/Office
Administration Department

vm

Enclosures

(717) 532-9121

QUESTIONNAIRE

A Study to Determine the Skills and Knowledge Required for Data Processing Personnel

I. Name of Business Firm_____

A. Total Number of office employees:

1. 1 to 10 ____ 3. 26 to 50 ____ 5. 101 to 200 ____
2. 11 to 25____ 4. 51 to 100____ 6. 201 to 300 ____
7. over 300 ____

B. Number of office employees engaged in data processing activities:

1. 1 to 10 ____ 3. 26 to 50 ____ 5. 101 to 200 ____
2. 11 to 25____ 4. 51 to 100____ 6. 201 to 300 ____
7. over 300 ____

II. Data Processing Personnel

A. Indicate number of employees and projected increase in number of employees needed in the next five years:

	Current Number	Projected Number in 5 years				
		None	1-5	6-10	11-20	over 20
Keypunch operator	____	____	____	____	____	____
Data entry operator	____	____	____	____	____	____
EAM operator	____	____	____	____	____	____
Computer console operator	____	____	____	____	____	____
Librarian (tape-disk)	____	____	____	____	____	____
Business programmer	____	____	____	____	____	____
Scientific programmer	____	____	____	____	____	____
Systems programmer	____	____	____	____	____	____
Systems analyst	____	____	____	____	____	____
Other, please specify _____	____	____	____	____	____	____

B. What are your minimum educational requirements for each job classification:

	High School	Vo-tech	2-yr. Associate Degree	Bachelors Degree	Other Please Specify_____
Keypunch operator	____	____	____	____	____
Data entry operator	____	____	____	____	____
EAM operator	____	____	____	____	____
Computer console operator	____	____	____	____	____
Librarian (tape-disk)	____	____	____	____	____
Business programmer	____	____	____	____	____
Scientific programmer	____	____	____	____	____
Systems programmer	____	____	____	____	____
Systems analyst	____	____	____	____	____

C. Are the following job classifications entry level positions:

	Yes	No
Keypunch operator	____	____
Data entry operator	____	____
EAM operator	____	____
Computer console operator	____	____
Librarian (tape-disk)	____	____
Business programmer	____	____
Scientific programmer	____	____
Systems programmer	____	____
Systems Analyst	____	____

D. Check the computer languages used by each job classification by indicating PERCENT of total language usage.

	COBOL	RPGII	FORTRAN	BASIC	ASSEMBLY	Other	Total
Business programmer	____	____	____	____	____	____	100%
Scientific programmer	____	____	____	____	____	____	100%
Systems programmer	____	____	____	____	____	____	100%
Systems analyst	____	____	____	____	____	____	100%
Other	____	____	____	____	____	____	100%

E. Indicate the desired educational background by PERCENT for the following job classifications:

	Business Background	Math/Comp Sci Background	Other
Business programmer	____	____	____
Scientific programmer	____	____	____
Systems programmer	____	____	____
Systems analyst	____	____	____
Other	____	____	____

F. Indicate the PERCENTAGE of total time spent by the different job classifications in each applications area:

	APPLICATIONS AREAS				
	Business	Scientific	Software	Hardware	Other
Business programmer	____	____	____	____	____
Scientific programmer	____	____	____	____	____
Systems programmer	____	____	____	____	____
Systems analyst	____	____	____	____	____
Other	____	____	____	____	____

III. Hardware

Make and model of computer_____

A. Check by indicating number of machines for the following equipment:

1. Unit record equipment:

Sorter	____	Accounting Mach.	____
Collator	____	Keypunch	____
Reproducer	____	Keyverifier	____
Interpreter	____		

2. Computer equipment:

Magnetic tape	____	Card reader	____
Magnetic disk	____	Card punch	____
Paper tape	____	CRT terminal	____
Magnetic drum	____	Teletype terminal	____
Key/tape	____	Batch terminal	____
Key/disk	____		

B. Place a check after each of the following input/output devices you use:

Keypunch	____	CRT terminal	____
Key/tape	____	Teletype terminal	____
Key/disk	____	Remote batch terminal	____
Key/cassette	____	Optical mark page reader	____
Disk drive	____	Optical scanner (OSR)	____
Tape drive	____	Optical character (OCR)	____
Paper tape reader/punch	____	Magnetic ink character (MICR)	____
Magnetic drum	____	Graphic units	____
Data cell	____	Audio response units	____
Card reader	____	Micro-film	____
Card punch	____		